SOIL SAMPLING AND ANALYSIS WORK PLAN

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1.0 INTRODUCTION

This Soil Sampling and Analysis Work Plan describes a field investigation to be implemented by Hecla Mining Co. (Hecla) at a lined waste impoundment (referred to as Pond 2) located at the Apex site in Washington County, Utah. This work plan has been prepared for Hecla by Shepherd Miller, Inc. (SMI).

1.1 EPA Order and Work Plans

Hecla received from EPA Region VIII, the *Order Requiring Monitoring, Testing, Analysis and Reporting issued pursuant to Section 3013 of RCRA, 42 U.S.C. § 6934, for the Hecla Pond, Shivwits Band Paiute Reservation, Washington County, Utah,* dated September 22, 1999 (the Order) (EPA, 1999), subsequent to an EPA RCRA compliance evaluation inspection conducted at Pond 2 in November 1998. The Order required that Hecla prepare two documents: (1) a soil sampling and analysis work plan, and (2) a leachate and runoff sampling and analysis work plan.

The two work plans were originally prepared in January 2000 to comply with the September 22, 1999 RCRA Order. The work plans were modified in September 2000 to address EPA comments on earlier versions of the plans (EPA, 2000a, 2000b). This plan is an update of the previous versions of the work plans, reflecting discussions with EPA Region VIII personnel in Denver on June 7, 2001.

1.2 Site Background

Pond 2 was used from approximately 1984 to 1995 for disposal of mineral beneficiation waste, waste from cobalt sulfate recovery operations and soil, liner materials, and sediment from site cleanup operations. Pond 2 is synthetically-lined, approximately 500 feet in diameter and 15 feet deep. Pond 2 and the immediately surrounding area are fenced and encompass approximately eight acres. The Pond 2 liner was professionally installed and supervised, and is comprised of a fabric-reinforced spray-on asphaltic membrane. The thickness of the membrane is approximately one-quarter to one-half inch.

As described in SRK (1989) the site is underlain by up to 30 feet of silty sand soils of aeolian and colluvial origin. Beneath these soils are a sequence of sandstones, siltstones and limestones (within the Triassic Moenkopi Formation) several hundred feet thick. Groundwater has been found in these fractured sedimentary rocks at a depth of 160 to 300 feet (SRK, 1984; Kleinfelder, 1995). The groundwater present in the fractured sedimentary rocks comprises the uppermost aquifer beneath the site, and provides makeup water for the operations at the site. Static water levels measured in groundwater characterization wells (installed in 1983) show a gradient for groundwater flow from south to north.

As described in SRK (1989), surface water drainage in the site area is from south to north. Runoff flows toward the Pond 2 area from the south, but is conveyed around Pond 2 by a diversion channel. Runoff from the Pond 2 area flows to the north, into a gravel pit excavated in the natural drainage does not continue to the stock watering pond (approximately 2,000 feet north of Pond 2).

1.3 Operational Background

In 1984, the St. George Mining Company leased approximately 180 acres from the Shivwits Band of Paiute Indian Tribe and constructed a mill for extraction of gallium and germanium from copper ore from the nearby Apex Mine. The 180-acre leased area is referred to as the Apex site. From 1984 to 1988, tailings from the gallium and germanium extraction process were discharged into Pond 2, as well as other impoundments at the site operated by St. George Mining Company.

Pond 2 was constructed with a perimeter embankment of on-site soil, with the pond bottom and inside embankment surfaces lined with a spray-on or blown asphalt liner of one-quarter to one-half inch thickness. Several of the other ponds on site were constructed in the same manner using the same contractor and construction quality assurance procedures (SRK, 1989). At the end of St. George Mining Company's operation, there were eight synthetically-lined ponds containing various amounts of solutions and solids from the gallium and germanium extraction process (Ponds 1A, 1C, 3A, 3B, 2A, 2, and a surge pond). An additional pond, designated as 1B, was not used by St. George Mining Company.

Hecla purchased the operation from St. George Mining Company in March 1989 and continued gallium and germanium extraction operation until 1990. In 1989, Hecla removed the St. George Mining Company materials from ponds 1A and 3A, placing this material in Pond 3B. Hecla re-lined Pond 3A and a combined pond 1A/B with a double HDPE liner system. During this period, the waste stream from the operation was treated with limestone and lime and sent to the re-lined ponds 1A/B and 3A in slurry form. No other ponds were used by Hecla. Following the shutdown of the gallium and germanium operation in 1990, Hecla operated a cobalt-sulfate recovery process at the Apex site until September 1995. This operation included disposal of certain non-hazardous wastes in pond 1A/B and 3A. The St. George Mining Company materials in Ponds 1C, 2A, and 3B were removed by Hecla and placed into Pond 2 between 1990 and 1995. These materials were generally mixed with limestone at the time of relocation.

In 1995, Hecla sold the operation to OMG Americas, Inc. (OMG), with the exception of the Pond 2 area, which was retained by Hecla. OMG continues to operate a cobalt recovery process at the site. Hecla entered into an Amendment to Lease with the Shivwits Band of Paiutes on September 25, 1995, to lease approximately eight acres of the original site (which incorporates Pond 2).

1.4 Pond 2 Closure

As part of the Purchase and Sale agreement with OMG, Hecla removed materials in and below the ore stockpile area and ponds at the site in accordance with soil cleanup standards established by Hecla and OMG. Hecla disposed of these materials in Pond 2. The excavated materials from the ore stockpile area were placed in the south end of Pond 2. The materials within Ponds 1 A/B were trucked to Pond 2 and dumped from either the pond perimeter or the ore pad fill area. The materials within Ponds 3A were dredged and pumped as a slurry to Pond 2. Free liquid from the Pond 3A cleanup was decanted, transferred to a lined pond, and subsequently evaporated. Pond liner materials and subsoils were excavated and trucked to Pond 2 for disposal. Estimated volumes produced during Hecla operation and site cleanup are listed in the Order, based on Hecla data.

As part of the site cleanup work, the perimeter embankment of Pond 2 was raised approximately five feet to provide sufficient capacity for material disposal. The embankment raise was accomplished by placing soils over the centerline of the original embankment.

Currently, Pond 2 is covered, with the perimeter of the leased area fenced. Following site cleanup work, the impoundment surface was leveled and preliminarily covered in a dome-shaped configuration using off-site borrow material. The cover is a combination of rock and topsoil, averaging approximately three feet in thickness. The maximum material thickness beneath the cover is estimated to be approximately 15 feet. A diversion ditch collects run-on from the south and east and conveys this flow around the east side of Pond 2 and into the excavated gravel pit north of Pond 2 on OMG property.

1.5 Seepage Mitigation

Seepage was first observed by Hecla in 1997 on the southwest side of Pond 2. This seepage was from porewater that had migrated through the perimeter embankment raise that was constructed for site cleanup operations. In order to intercept this seepage, Hecla constructed a synthetically-lined ditch that flows to a synthetically-lined evaporation pond on the southwest side of Pond 2.

In 1997, Hecla observed an additional moist area on the east side of Pond 2. There was insufficient seepage to collect, so no interception work was done, and this area has dried out since 1997.

In November 1998, Hecla constructed a second evaporation pond (Evaporation Pond 2) to increase the holding and evaporation capacity of the seepage water from the southeast corner of Pond 2. At the same time a berm and ditch were constructed to divert up-gradient stormwater runoff from collecting in the evaporation pond area. During the summer of 1999, water from the existing evaporation pond (Evaporation Pond 1) was transferred via a portable pump to the newly constructed Evaporation Pond 2.

Hecla made additional modifications to the evaporation pond system in January 2000. Hecla transferred the material, water, and liner from Evaporation Pond 2 into a pit excavated through

the top of Pond 2. The Evaporation Pond 2 area was then backfilled with borrow material. The channel to Evaporation Pond 1 was also excavated, and the material placed into the pit in Pond 2. The pit was then covered and leveled. A new, wider collection ditch (approximately 5 feet wide, 80 feet long, and 1 foot deep) was constructed as well as a new evaporation pond (Evaporation Pond 3), parallel to the edge of Pond 2. Evaporation Ponds 2 and 3 (located at the southwest corner of Pond 2), were lined with UV-resistant polyvinyl chloride (PVC) material.

The evaporation system was re-lined in March 2001 using MDPE. The size of both ponds was increased as a result of the old liner excavation. Also, the side walls were sloped to improve liner wear and decrease the chance of tears. The ditch between the ponds was reshaped to serve as an overflow ditch.

At this time the system nomenclature and labeling was modified to more accurately reflect the system use. Evaporation pond 3 as renamed collection pond 1. The current dimensions are:

- collection pond 1: 5 feet wide, 35 feet long and 1 foot deep
- overflow ditch: 8 feet wide, 50 feet long and 1 foot deep
- evaporation pond 2: 12 feet wide, 85 feet long and 4 feet deep

2.0 SOIL SAMPLING AND ANALYSIS

2.1 Objective

Based on discussions with EPA on June 7, 2001, the specific objective of this work plan is to assess the extent of and potential for seepage migration from Pond 2 by evaluation of key physical conditions inside and outside of Pond 2. A single drilling and sampling event is anticipated to achieve this specific objective.

All sampling activities will be performed in a manner consistent with applicable portions of EPA Region VIII's Field Sampling Guide (EPA, 1996), the QA/R-5 (EPA, 1998), and EPA SW-846 (EPA, 1986). Quality assurance methods are described in the Quality Assurance Project Plan (QAPP) included as Attachment A to this document. A health and safety plan (HASP) prepared for this program is included as Attachment B to this document, which presents the human health and safety requirements and guidelines for performance of the work.

2.2 Drilling Locations

Two locations for drilling and sampling are proposed within Hecla leased property: (1) within Pond 2, and (2) the area of observed seepage outside the perimeter of Pond 2. These locations were selected based on discussions with EPA on June 7 and August 14, 2001, and are described below.

Area within Pond 2. The purpose of drilling and sampling within Pond 2 is to evaluate the physical conditions of the waste materials present. These physical conditions (specifically degree of saturation and density) would be used to assess: (1) the potential for seepage migration through the liner and (2) the degree of consolidation of waste materials present in Pond 2.

The materials in Pond 2 are listed below in order of placement.

1. Tailings from St. George Mining Company and Hecla gallium/germanium recovery operations (discharged as a slurry).
2. Lime-neutralized waste and liner materials excavated by Hecla from cleanup of other ponds at the site (excluding Pond 1 A/B), placed in Pond 2 with earthmoving equipment.

3. Residual ore and underlying subsoils from Hecla cleanup of the ore stockpile area (placed in Pond 2 with earthmoving equipment).

4. Lime-neutralized waste and liner materials excavated by Hecla from cleanup of Pond 1 A/B (placed in Pond 2 with earthmoving equipment).

5. Soils from site cleanup (placed in Pond 2 with earthmoving equipment).

6. Liquids and sediments from cleanup of Pond 3A (discharged as a slurry).

7. Native soils from nearby borrow areas used for cover material (placed on top of Pond 2 with earthmoving equipment).

Drilling and sampling within Pond 2 will be conducted to evaluate the moisture and density conditions of these materials. However, this will be done in a manner that does not damage or penetrate the existing liner.

Area of observed seepage outside the perimeter of Pond 2. The purpose of sampling in the area of observed seepage near the southwest corner of Pond 2 is to evaluate the physical conditions of the subsoils (specifically degree of saturation). This information would be used to assess the extent of seepage migration with depth into the subsoils. The proposed drilling and sampling location is adjacent to the existing evaporation ponds.

2.3 Drilling and Sampling

The proposed program consists of drilling three holes inside and one hole outside of Pond 2. A standard, truck-mounted geotechnical drilling rig will be used with hollowstem augers for advancing and temporary casing the hole. A dry-core sampler would be the first choice in collecting samples on a continuous basis. If the dry-core sampler is not successful, a split-spoon sampler would be used. Every attempt would be made to collect representative samples throughout the length of each drill hole. Sampling will be supplemented by detailed logging of the drilled profile, conducted by a certified engineer or geologist. Drilling in the two areas is described below, with the auger hole outside of Pond 2 drilled and sampled first.

Auger hole within Pond 2. The first auger hole will be near the center of the pond. The depth of the pond at this point is approximately 12 feet, based on the original design drawings

(although the as-built depth is not known). The depth of drilling is anticipated to be at least 10 feet, with the ultimate depth depending on the degree of saturation observed during sampling. Every attempt will be made to drill and collect samples as close to the liner as possible without compromising the integrity of the liner. The second and third auger holes will be located midway between the first hole and the location of the two seeps described in Section 1.5. The pond depth at the location southeast of the center auger hole is approximately 7 feet. The drilling depth at this location will be at least 5 feet. The pond depth at the location east of the center auger hole is approximately 9 feet. The drilling depth at this point will be at least 7 feet. The ultimate depth of these holes will be dependent on field observations, and may be need to be limited to preserve the integrity of the liner. After sampling has been completed at the three locations, the bottom one foot of each hole will be backfilled with a thick bentonite slurry prior to replacing the cuttings.

Auger hole outside of Pond 2. The location of the auger hole outside of Pond 2 will be adjacent to the existing evaporation ponds. The depth of drilling will be roughly 30 feet, or through the contact between surficial soils and underlying sedimentary rock. If materials at this geologic contact show a high degree of saturation, drilling into the sedimentary units will continue as far as necessary to determine the vertical extent of moisture migration. Drilling will be discontinued if the materials at the geologic contact show no evidence of saturated conditions.

Based on the field observations from drilling the auger hole outside of Pond 2, the need for additional auger holes will be determined jointly by Hecla and EPA personnel on site. If additional auger holes are determined to be necessary, a new work plan would be developed by Hecla and submitted to EPA for approval. The schedule for developing and submitting that plan would be jointly agreed to by Hecla and EPA.

Soil and other solid material samples will be collected according to methods described for soil sampling in Standard Operating Procedure (SOP) No. 3. Additionally, procedures described for decontamination in SOP No. 4 will be used. Procedures for sample handling, documentation and analysis described in SOP No. 5 will be used during sampling. These SOPs are included in Attachment C to this work plan.

The auger holes will be backfilled after completion of logging and sampling, and closed in accordance with applicable requirements from the Utah State Engineer's Office. Any exposed waste will be backfilled in the auger hole beneath the depth of the soil cover on Pond 2.

2.4 Decontamination

Decontamination procedures are described in SOP No. 4, and are summarized below.

Drilling equipment (hollowstem augers, auger bits, and drilling rods) in contact with waste materials but not in contact with samples will be decontaminated prior to leaving the site. Because sampling is to be conducted within drilling augers, the inside auger surfaces will not be in contact with materials to be collected for sample analysis and decontamination of augers between holes is not necessary.

Sampling equipment (drilling samplers, hand augers, and other sampling tools) in contact with samples will be decontaminated after each use.

Decontamination will be conducted by pressurized steam cleaning or by hand washing (with a decontamination solution) and rinsing. The decontamination area will be an excavated or formed area within the cover on top of Pond 2, where decontamination water can be collected and allowed to infiltrate into the Pond 2 materials.

2.5 Sample Testing

All of the collected samples will be logged, with specific samples selected for laboratory analysis by Hecla and EPA field personnel. If requested, sample splits will be provided to EPA (or other parties) in the field at the time of sample collection.

Solid material samples will be tested according to applicable ASTM methods, or other methods satisfactory to EPA (such as EPA, 1986 if applicable). The laboratory will be selected based on joint agreement between Hecla and EPA personnel. The anticipated tests will include natural dry density, unit weight, moisture content, specific gravity of solids, particle-size distribution, and consolidation. Preliminary measurements of natural wet density will be made on site.

2.6 Quality Assurance

Where applicable, sampling activities will be performed in a manner consistent with EPA Region VIII's Field Sampling Guide, and the QA/R-5 (EPA, 1996, 1998) as well as EPA (1986). Quality assurance methods are described in the Quality Assurance Project Plan (QAPP) included as Attachment A to this work plan.

3.0 SCHEDULE

According to Paragraph No. 70 of the EPA Order, Hecla is required to implement the work plan within 10 days following EPA approval (or approval with modification) of the work plan. Implementation of the work plan will include final contracting and scheduling of the drilling or excavation subcontractors. Hecla will notify the EPA, Tribal and BIA representatives identified in Paragraph Nos. 65 and 66 of the Order in writing within 10 calendar days before engaging in any field activities at the Apex site.

As described in Paragraph No. 64 of the EPA Order, Hecla will submit to EPA a final report within 45 days of work completion. Work completion will consist of final approval of laboratory analyses (following data validation). As required by the EPA Order, the report will define the nature, location, extent, direction, and rate of movement of any constituents identified at or as having been released from the facility.